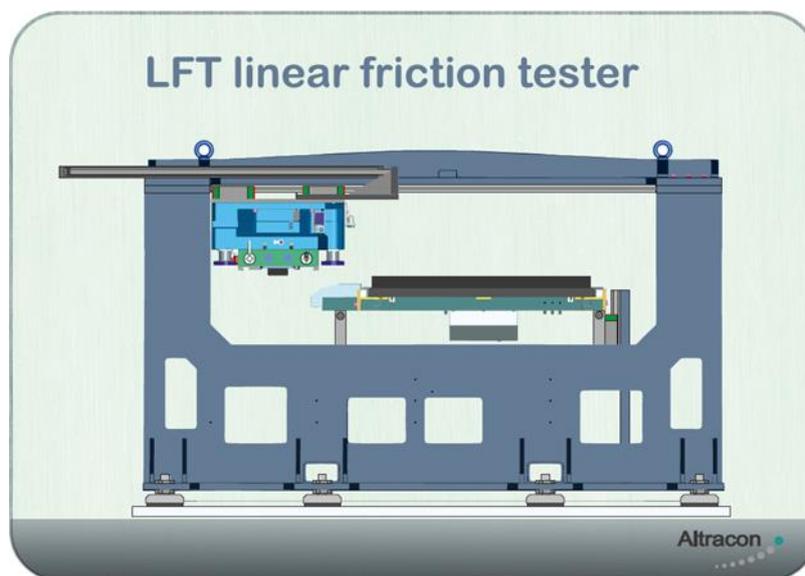


Linear Friction Tester (LFT)

Measuring the real μ indoor and outdoor

- Determination of friction coefficients of rubber samples
- Any road type/ track surface
- Top sliding performance F_x 5.000 N / 2 m/s / 40 m/s²
- High performance pneumatic loading system F_z max 3.000 N
- Prediction of compound and pattern influences on grip and traction performance
- Powerful hydraulic motion drive
- Indoor use allows:
 - Any operating condition including all tire load classes (MC/ PC/ LT/ T&B/ Aircraft)
 - Any environmental condition -25°C (-13°F) to +50°C (122°F)
 - Full environmental and conditions control
 - Special technologies to produce ice- and snow tracks
 - Tread block analyses with synchronized high Speed camera system
 - Upgradable for future needs
 - Modules for conditioning and cleaning
- Scanner for tracks and samples for wear
- Highly cost efficient



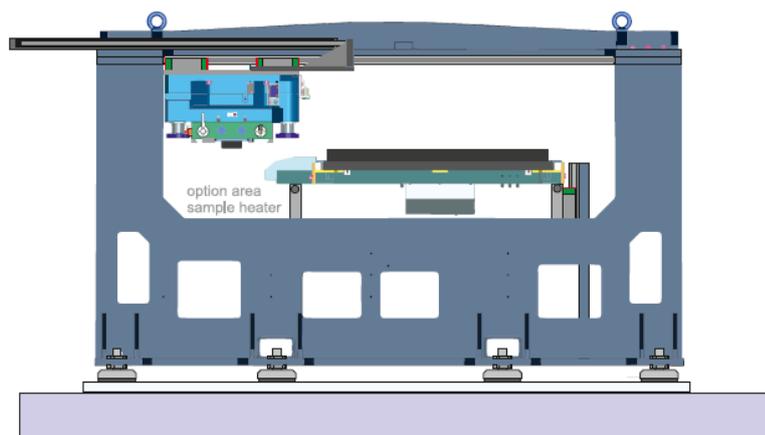
A key solution for development engineers

LFT is a friction tester, neither for measurement of wear nor abrasion. Friction testing with the LFT is a huge step forward in the process of tire development. It reduces risk by increasing the number of test cycles offers the customer a far shorter delay of launching his product by reducing the number of road tests and cuts development costs by creating an indoor all-season tire test environment.

The Linear Friction Tester - LFT is the “small brother” of the High Speed Linear Friction Tester – HSLFT, which is established as the reference for friction testing in tire industries. The LFT is developed to determine friction coefficients of rubber samples on different surfaces and under various operating conditions in order to predict compound and pattern influences on the grip and traction performance of tires with lower performance and limited variability of testing compared to the HSLFT but with the same precision and similar functionality. Both systems are compatible.

The LFT is made to **measure the real linear friction** of compounds in a discretionary direction of the compound sample on various surfaces incl. real road tracks at any environmental condition. The measurement may be combined with records from a high-speed camera taken synchronously from the sample to support the interpretation of data measured with the HSLFT and to perform tread block analyses. It is neither a wear nor abrasion tester.

The testing machine was designed and constructed in such a way that all relevant tire testing conditions can be simulated with this equipment. The sample is moved with a hydraulic actuator with performance of 5.000 N Fx (continuous), which allows sliding velocities up to 2,0 m/s and generates accelerations up to 40 m/s². Loading with vertical forces up to 3.000 N can be applied. The load application is done with a new hybrid loading system using a combined hydraulics and pneumatics technology to cover the full operating range.

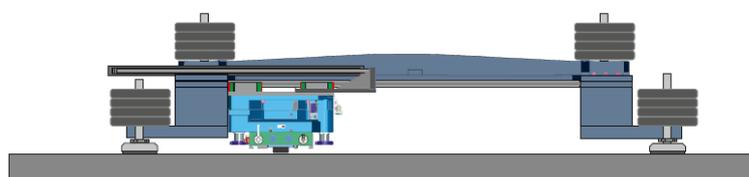


LFT set-up for indoor use

The rubber sample is vulcanized or bonded to a carrier. It will be loaded to the testing surface, which is applied to an exchangeable cassette and will be rubbed over it by motion of the track before it is unloaded again. A rotational sample holder allows to adjust the direction relative to the track. The process is controlled with variable parameters. The environment is usually conditioned and -depending on the equipment of the machine- also the test specimen and the track.

Indoor- and outdoor testing of friction

The LFT is available for indoor- and outdoor use. The LFT for outdoor friction testing only uses the upper part of the machine with the measuring head and the high performance hydraulic drive, which is directly loading the sample to the real track, while the indoor version is equipped with the track intake on a massive machine base-frame to measure the friction on the prepared track cut outs. The outdoor version also includes levelling and positioning features to enable fast and repeatable adjustment to the road surfaces at various locations.



LFT set-up for outdoor use

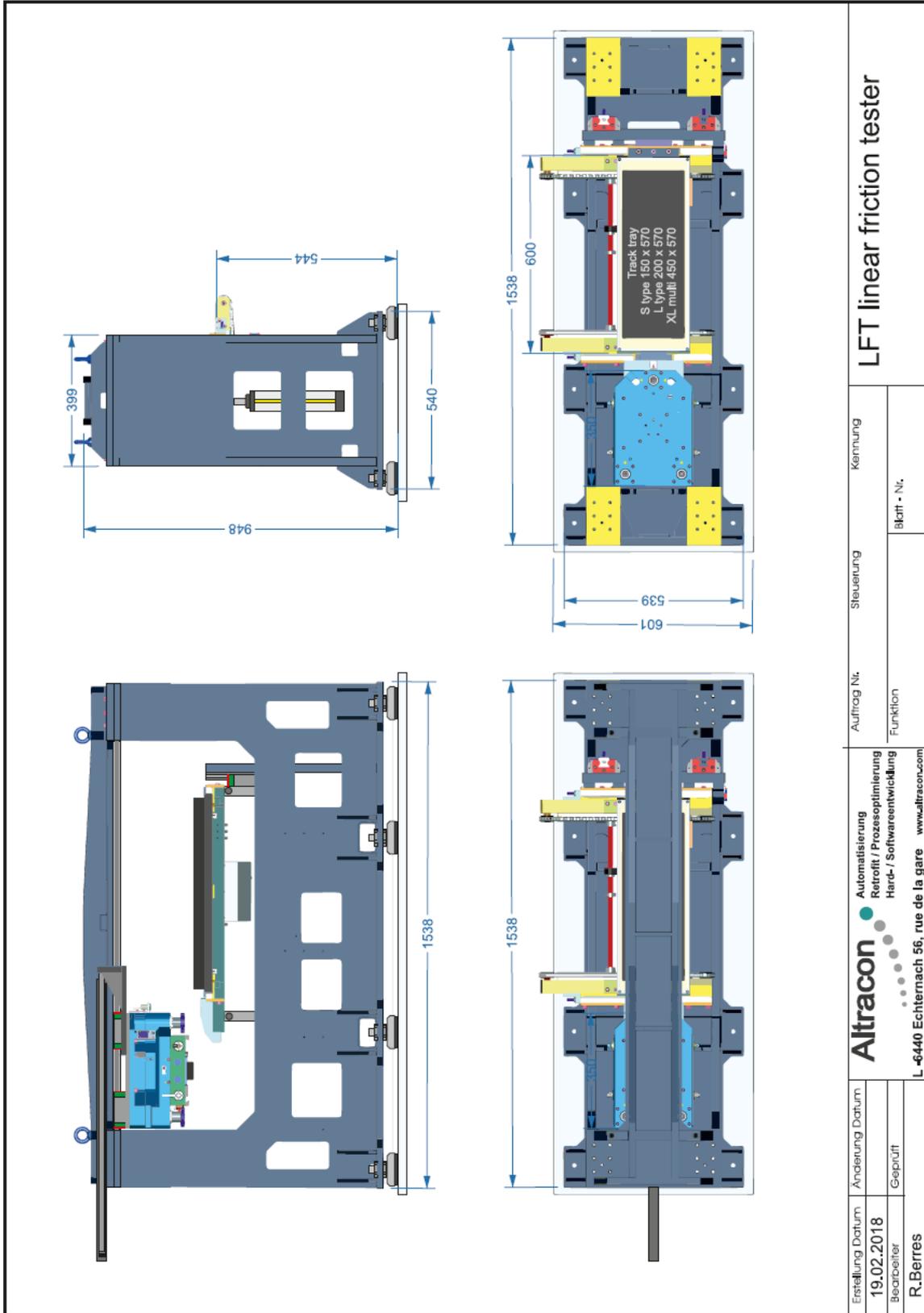
LFT Technical Specification

The Linear Friction Tester is a compact and modular system. Customization with various options is possible. However, performance limits are shown in the table below.

PARAMETER	MEASURING RANGE	ACCURACY
Longitudinal force F_x	0 ... 5000 N continuous	± 0.1 % of set range (500/ 1000/ 5000N)
Lateral force F_y	0 ... 500 N	± 0.1 % of set range (500/ 1000/ 5000 N)
Vertical force (load) F_z	20 ... 3000 N	± 0.1 % of set range (500/ 1000/ 5000 N)
Sliding distance/ positioning S_x	0 ... 500 mm total 0 ... 300 mm testing	10 μ m
Vertical travel/ positioning S_z	0 ... 20 mm	1 μ m
Sliding velocity V_x	0,001 ... 2,0 m/s	± 0.001 m/s
Loading-/ unloading time	≥ 20 ms	
Longitudinal acceleration a_x	0 ... 40 m/s ²	≤ 1 % FS
Sample holder rotation angle $\alpha(z)$	0 ... 360°	1° (manual adjustment)
Sample temperature T_{sample}	RT* ... 200°C with opt. heater	± 0.5 °C
Track temperature T_{track}	RT* ... 200°C with optional heater -25° ... 180°C with opt. conditioner	± 0.5 °C
Temperature test room T_{Test}	5° ... 50°C with opt. climatic chamber -25° ... 50°C with opt. freezing pack	± 1 °C
Sample rate	100 Hz ... 20 kHz per channel	

*) RT = Room Temperature

- 1) Speed depending on test method
- 2) RT = Room Temperature



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